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SAVANNAH RIVER NATIONAL LABORATORY

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## News from the Savannah River National Laboratory

*May 31, 2007 For immediate release*

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### **SRNL ACHIEVES MILESTONE EN ROUTE TO HYDROGEN ECONOMY**

AIKEN, S.C. – The U.S. Department of Energy's Savannah River National Laboratory has successfully completed a 100-hour long demonstration of the sulfur dioxide depolarized electrolyzer, designed and fabricated by SRNL, to produce hydrogen from water. This represents a significant milestone in the development of an efficient, economical process for generating large quantities of hydrogen to fuel the nation's future. This demonstration showed that the electrolyzer can successfully operate continuously without significant loss of performance.

"Successful development of the Hybrid Sulfur Process could lead to sustainable, large-scale, economical hydrogen production using advanced nuclear reactors, with no greenhouse gas emissions," said Dr. William Summers, SRNL's program manager for nuclear hydrogen production programs.

This electrolyzer is a key component of the Hybrid Sulfur (HyS) thermochemical process, which provides a means of using heat from next-generation nuclear reactors to generate hydrogen from water. In previous demonstrations, the electrolyzer had only been operated for short durations. The 100-hour demonstration, achieved approximately one month ahead of schedule, was an important milestone required by DOE's Office of Nuclear Energy, which funds development of the Hybrid Sulfur Process in support of the Hydrogen Fuel Initiative.

The Hybrid Sulfur Process is one of the leading candidates for using high-temperature heat from advanced nuclear reactors to generate hydrogen from water. It makes use of two types of chemical reactions to split water and generate hydrogen and oxygen. The first, an electrochemical reaction, uses electricity to power the electrolyzer in order to isolate the hydrogen at one pole of the device, allowing it to be collected and stored for use. In addition to water, the electrochemical reaction uses sulfur dioxide, which is recycled in the process. The second type of reaction, thermochemical, uses high-temperature heat, which could be provided by a nuclear reactor, to regenerate the sulfur dioxide and release oxygen.

An important factor in the efficiency of the Hybrid Sulfur Process is low cell voltage required by the electrolyzer, which determines the amount of electricity needed. In the 100-hour test, SRNL's electrolyzer required about 0.8 volts per cell, leaving researchers optimistic that the commercial goal of 0.6 volts per cell can be achieved when operating the electrolyzer at higher temperature and pressure.

Future work will seek to further improve the cell performance and extend its operational durability. SRNL is currently building a larger, multi-cell electrolyzer. Plans call for beginning construction of an integrated lab-scale

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Hybrid Sulfur Process, including the larger electrolyzer, during the next fiscal year. The long-term goal is to build an engineering demonstration of the HyS Process that can be operated in conjunction with DOE's planned Next Generation Nuclear Plant, scheduled for operation after 2017 at the Idaho National Laboratory.

Hydrogen, though plentiful across the planet, is usually found locked up in water or other compounds. Being able to use hydrogen as a fuel requires extracting the hydrogen from water or hydrocarbons. Since 2003, SRNL has studied the technical and economic issues surrounding the use of a new generation of nuclear reactors to "crack" water to produce hydrogen that could be used to fuel America's vehicles.

SRNL is the applied research and development laboratory at DOE's Savannah River Site, putting science to work in the areas of energy security, national and homeland security, and environmental management. The laboratory is operated for DOE by Washington Savannah River Company, a subsidiary of Washington Group International.

WSRC-07-16

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